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TITLE: ORGANIC EL ELEMENT

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ABSTRACT:

PROBLEM TO BE SOLVED: To provide an organic EL element that is not uneven in brightness and has high emission stability although employing a transparent resin substrate as its transparent substrate.

SOLUTION: A transparent thermosetting-resin substrate having a flat surface is used as a transparent resin substrate, a transparent electrode made of a crystalline transparent conductive film with a grain size of 500 angstroms or less or an amorphous transparent conductive film is formed over the flat surface of the transparent thermosetting resin substrate via a moistureproof inorganic oxide film, and a counter electrode is formed over the transparent electrode via an organic single-layered part or an organic multilayered part containing an organic emitter, to form an organic EL element.

* NOTICES *

JP 09-129376.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to an organic electroluminescence (electroluminescence is hereafter written as "EL".) component, and relates to the organic EL device using a transparence resin substrate especially.
[0002]
[Description of the Prior Art] Since an EL element is self-luminous, its visibility is high, and the use to various kinds of display devices, surface light sources, etc. is tried. [have / since it is a perfect solid-state component / the descriptions, such as excelling in shock resistance,] Although an EL element is divided roughly into an inorganic EL element and an organic EL device, the organic EL device not only has the advantage that driver voltage can be sharply reduced compared with an inorganic EL element, but has the description that full-color-izing including blue is possible.
[0003] The organic EL device which has the above-mentioned description usually has the organic monolayer section containing a transparent electrode and an organic luminescent material or the organic multilayer section, and the structure that carried out the laminating of the counterelectrode one by one on the transparence substrate, and the indium stannic-acid ghost film (henceforth the "crystalline substance ITO film") of a crystalline substance is used abundantly from before from the reasons nil why transparency and conductivity are high etc., as a transparent electrode. The magnitude (grain size) of the microcrystal grain of the front face of the crystalline substance transparent electrode concerned has influenced the brightness nonuniformity and luminescence stability of a component greatly, there is no brightness nonuniformity by making this grain size into 500A or less, and it is known for the organic EL device using the transparent electrode (henceforth a "crystalline substance transparent electrode") which consists of crystalline substance matter that an organic EL device with high luminescence stability will be obtained (refer to JP,6-76950,A).
[0004] By the way, although the glass substrate has been conventionally used as a transparence substrate of an organic EL device, in order to aim at lightweight-izing and the further shock-proof improvement in an organic EL device, using a transparence resin substrate as a transparence substrate is examined. And to use the substrate which consists of thermoplastics, such as polymethylmethacrylate, polystyrene, and polyethylene terephthalate, as this transparence resin substrate is tried (refer to JP,2-251429,A).
[0005]
[Problem(s) to be Solved by the Invention] However, when the thermoplastics substrate mentioned above as a transparence substrate of an organic EL device is used, there is no brightness nonuniformity and an organic EL device with high luminescence stability cannot be obtained.
[0006] In spite of using the transparence resin substrate for the purpose of this invention as a transparence substrate, it does not have brightness nonuniformity and is to offer the organic EL device which can obtain what has high luminescence stability.
[0007]
[Means for Solving the Problem] The result wholeheartedly studied about the reason for the ability not

to obtain [this invention persons do not have brightness nonuniformity, when a thermoplastics substrate is used, and] an organic EL device with high luminescence stability, (1) The surface smoothness on the front face of a transparent electrode which the surface smoothness of the front face of a thermoplastics substrate was low, therefore formed on the thermoplastics substrate concerned primarily is also spoiled. (2) With it difficult [for the thermoplastics substrate concerned to form the crystalline substance transparence electric conduction film with a grain size of 500A or less on the substrate temperature conditions of not causing heat deformation, on a thermoplastics substrate] (3) The crystalline substance transparence electric conduction film with a grain size of 500A or less Although it can obtain also by giving UV ozone exposure and ion irradiation to the crystalline substance transparence electric conduction film concerned once forming the crystalline substance transparence electric conduction film with which grain size exceeds 500A (refer to JP,6-76950,A) If UV ozone exposure and ion irradiation are performed and grain size of the crystalline substance transparence electric conduction film concerned is made into 500A after forming the crystalline substance transparence electric conduction film with which grain size exceeds 500A on a thermoplastics substrate Since the thermoplastics substrate received damage by UV ozone exposure or ion irradiation, there is no brightness nonuniformity and it found out that an organic EL device with high luminescence stability could not be obtained.

[0008] The organic EL device of this invention which this invention is made based on such knowledge, and attains the above-mentioned purpose A transparence resin substrate and the transparent electrode formed through the dampproof inorganic oxide film on this transparence resin substrate, It has the counterelectrode formed on said transparent electrode through the organic monolayer section or the organic multilayer section containing an organic luminescent material. Said transparence resin substrate consists of a transparence thermosetting resin substrate which has a flat side. Said dampproof inorganic oxide film is formed on said flat side of this transparence thermosetting resin substrate, and it is characterized by said transparent electrode consisting of the crystalline substance transparence electric conduction film or the amorphous transparence electric conduction film with a grain size of 500A or less.

[0009]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail. As the organic EL device of this invention was mentioned above, it has the transparence resin substrate, the transparent electrode formed through the dampproof inorganic oxide film on this transparence resin substrate, and the counterelectrode formed on said transparent electrode through the organic monolayer section or the organic multilayer section containing an organic luminescent material, and the aforementioned transparence resin substrate consists of a transparence thermosetting resin substrate which has a flat side.

[0010] Here, the surface smoothness which the "flat side" as used in the field of [substrate / transparence thermosetting resin] this invention does not have brightness nonuniformity, means the field which has the surface smoothness which can obtain an organic EL device with high luminescence stability, and is required of the "flat side" concerned differs according to the quality of the material, the formation approach, etc. of the quality of the material of the dampproof inorganic oxide film and the formation approach, and a transparent electrode. For example, when forming the dampproof inorganic oxide film and transparent electrode of the quality of the material which are mentioned later with physical vapor deposition, as for the "flat side" concerned, it is desirable that the mean square value of surface roughness is 300A or less, and that the number of the projections of 600A or more is 20 or less fields exists in the field of 500-micrometer angle on the flat side concerned. In addition, "the mean square value of surface roughness" as used in the field of [side / above-mentioned / flat] this invention is a mean square value of the gap from the average of the height about surface irregularity, and means extent of the magnitude of surface irregularity. Moreover, the "number of the projections of 600A or more which exist in the field of 500-micrometer angle on a flat side" as used in the field of this invention means a number of a projection with a height of 600A or more of averages which exist in each of the field of 500-micrometer angle set up ten places on the aforementioned flat side at arbitration. It

can ask for the height of the projection in each field, and its number using an electron microscope, an atomic force microscope, etc.

[0011] As for the transparence thermosetting resin substrate which has the above-mentioned flat side, it is desirable for the permeability of light with a wavelength of 400-700nm to be 90% or more preferably 70% or more. As such a transparence thermosetting resin substrate, what consists of transparence thermosetting resin of the point of transparency and a moldability to a polyolefine system is desirable, and the polyolefine system copolymer to which it comes to carry out the polymerization of the constituent containing the polyfunctional monomer which has two or more partial saturation radicals is used more preferably.

[0012] As an example of the above-mentioned polyfunctional monomer of having two or more partial saturation radicals (i) Ethylene GURIKORUJI Acrylate, diethylene GURIKORUJI (Meta) Acrylate, TORIECHIRENGURIKORUJI (Meta) Acrylate, GURISERORUJI (Meta) Acrylate, glycero RUTORI (Meta) Acrylate, a TORIMECHI roll pro pansy (Meta) Acrylate, a TORIMECHI roll pro pantry (Meta) The G of polyhydric alcohol, such as acrylate, pen TAERISURITORUJI (meta) acrylate, pen TAERISURITORUTORI (meta) acrylate, and pentaerythritol tetrapod (meta) acrylate, a tree, and tetrapod-(meta) acrylate (Meta) (ii) Aromatic series polyfunctional monomers, such as p-divinylbenzene and o-divinylbenzene, Ester, such as (iii) acrylic-acid (meta) vinyl ester and acrylic-acid (meta) allyl ester (iv) Dienes, such as a butadiene, hexadiene, and pentadiene, and (v) The monomer which has the FOSUFAZEN frame which introduced the polymerization polyfunctional radical by using dichloro FOSUFAZEN as a raw material, (vi) The polyfunctional monomer which has different atom annular frames, such as triallyl isocyanurate, is mentioned.

[0013] As for the above-mentioned transparence thermosetting resin, it is desirable to contain various ultraviolet ray absorbents, an antioxidant, and an antistatic agent from each viewpoint of lightfastness, anti-oxidation degradation nature, and antistatic nature. When transparence thermosetting resin is the above-mentioned polyolefine system copolymer, as for the polyolefine system copolymer concerned, it is desirable to use the monomer which has ultraviolet absorption nature or antioxidizing nature. The acrylic-acid monomer which has as a substituent the benzophenone system ultraviolet ray absorbent which has a partial saturation double bond, the phenyl benzoate system ultraviolet ray absorbent which has a partial saturation double bond, and a hindered amino group as a desirable example of such a monomer (meta) is mentioned. As for these monomers, it is desirable to be used in 0.5 - 20wt% to the whole quantity of the monomer used in order to obtain the polyolefine system copolymer made into the purpose.

[0014] As long as the transparence thermosetting resin substrate which constitutes the organic EL device of this invention has the flat side mentioned above, it may be obtained by what kind of polymerization method and the shaping approach. Moreover, although the thickness is selectable suitably according to the application of the organic EL device made into the purpose etc., when consisting of a polyolefine system copolymer which the transparence thermosetting resin substrate concerned mentioned above, as for the thickness, it is desirable that it is 0.1-1.5mm in consideration of a mechanical property, and it is more desirable that it is 0.1-1.0mm.

[0015] The dampproof inorganic oxide film is formed on the flat side in the transparence thermosetting resin substrate mentioned above mentioned above. This dampproof inorganic oxide film is for giving gas barrier property to the transparence thermosetting resin substrate mentioned above, in order to prevent that oxygen and moisture invade into the organic monolayer section or the organic multilayer section containing an organic luminescent material mentioned later. As an example of the dampproof inorganic oxide film concerned, the film which consists of silicon oxide (SiOx), aluminum oxide (aluminum2Ox), a titanic-acid ghost (TiOx), a zirconic acid ghost (ZrOx), yttrium oxide (Y2Ox), ytterbium oxide (Yb2Ox), magnesium oxide (MgOx), a tantalic acid ghost (Ta2Ox), cerium oxide (CeOx), or hafnium oxide (HfOx) is mentioned.

[0016] Although the thickness of the dampproof inorganic oxide film can be suitably changed according to the quality of the material of the dampproof inorganic oxide film concerned, it is within the limits of 50-2000A in general. If thickness is too thin, desired gas barrier property cannot be given to a

transparence thermosetting resin substrate. If thickness is too thick, as a result of light transmission nature's falling on the other hand, the brightness of an organic EL device falls. As for the thickness of the dampproof inorganic oxide film, considering as 100-1200A is desirable.

[0017] The thing high to the same extent as the surface smoothness of the flat side in the transparence thermosetting resin substrate which is the substrate of the dampproof inorganic oxide film [from / in there being no brightness nonuniformity and obtaining an organic EL device with high luminescence stability] concerned and which was mentioned above of the surface smoothness of the front face of the dampproof inorganic oxide film is desirable. The dampproof inorganic oxide film which has such surface smoothness can be formed by approaches, such as the sputtering methods, such as a dc system, a magnetron method, and a high frequency discharge method, and vacuum evaporation technique, the ion plating method, a plasma-CVD method. Even when forming the dampproof inorganic oxide film by which approach, as for the substrate temperature at the time of membrane formation, it is desirable that the transparence thermosetting resin substrate mentioned above considers as the temperature which does not cause heat deformation substantially. If a transparence thermosetting resin substrate causes heat deformation at the time of membrane formation of the dampproof inorganic oxide film, there will be no brightness nonuniformity and it will become difficult to obtain an organic EL device with high luminescence stability.

[0018] The transparent electrode currently formed on the dampproof inorganic oxide film mentioned above consists of the crystalline substance transparence electric conduction film or the amorphous transparence electric conduction film with a grain size of 500A or less, as mentioned above. Although this transparent electrode may consist of crystalline substance transparence electric conduction film and it consists of amorphous transparence electric conduction film, about what consists of crystalline substance transparence electric conduction film, grain size is limited to a thing 500A or less as mentioned above. If grain size exceeds 500A, there will be no brightness nonuniformity and it will become difficult to obtain an organic EL device with high luminescence stability. In addition, "the crystalline substance transparence electric conduction film with a grain size of 500A or less" as used in the field of this invention means the crystalline substance transparence electric conduction film whose grain size in the near film front face in which the organic monolayer section or the organic multilayer section mentioned later is formed is 500A or less. It can ask for grain size using an electron microscope, an atomic force microscope, etc.

[0019] When a transparent electrode consists of the above-mentioned crystalline substance transparence electric conduction film, as for the grain size of the crystalline substance transparence electric conduction film concerned, it is desirable that it is 10-500A. Moreover, as an example of the quality of the material, although a crystalline substance ITO, the tin oxide, a zinc oxide, copper iodide, etc. are mentioned, the viewpoint of transparency and low electric resistance to especially the crystalline substance ITO is desirable.

[0020] The crystalline substance transparence electric conduction film with a grain size of 500A or less can be directly formed on the dampproof inorganic oxide film mentioned above by approaches, such as the ECR plasma (electronic SAIKU roton resonance plasma) sputtering method and the sputtering method of a high-frequency-discharge method. Moreover, the crystalline substance transparence electric conduction film with a grain size of 500A or less can be obtained also by irradiating ion, such as UV ozone exposure or oxygen ion, nitrogen ion, and argon ion, after once obtaining the crystalline substance transparence electric conduction film on which grain size exceeds 500A by approaches, such as the magnetron sputtering method, vacuum evaporation technique, and the ion plating method, until the grain size becomes 500A or less to the crystalline substance transparence electric conduction film concerned. The conditions of UV ozone exposure are 10 minutes - amount part [for /] and substrate temperature of 10-30 degrees C of 10l. of oxygen gas installation, and irradiation time 5 hours. [in the dominant wavelength of 2537A of the light source, 1849A, and an exposure tub] Moreover, the conditions of ion irradiation are 10 seconds - exposure tub 10-6 to ten to 1 Pa internal pressure, exposure drive electrical-potential-differences 10-1000V, and irradiation time 1 hour.

[0021] In addition, since it is the same as that of the case where the dampproof inorganic oxide film is

formed even when forming the crystalline substance transparence electric conduction film by which approach, as for the substrate temperature at the time of membrane formation, it is desirable that the transparence thermosetting resin substrate mentioned above considers as the temperature which does not cause heat deformation substantially. Moreover, UV ozone exposure and ion irradiation which were mentioned above may be performed to the crystalline substance transparence electric conduction film with a grain size of 500A or less. When UV ozone exposure and ion irradiation are performed, defecation of a crystalline substance transparence electric conduction film front face can be attained without damaging a transparence thermosetting resin substrate.

[0022] On the other hand, as an example of the quality of the material of the aforementioned amorphous transparence electric conduction film, the amorphous oxide film which contains an indium element and a zinc element as a main cation element is mentioned. Here, the "amorphous transparence electric conduction film" as used in the field of this invention means the transparence electric conduction film which has the structure where a lattice constant is not determined by the transparence electric conduction film which has the structure where a grain boundary is not observed by the gestalt observation by the electron microscope, an atomic force microscope, etc., or electron diffraction.

[0023] When using the above-mentioned amorphous oxide film which contains an indium element and a zinc element as a main cation element as amorphous transparence electric conduction film, as for atomic ratio In/(In+Zn) of the indium in the amorphous oxide film concerned, it is desirable that it is 0.55-0.90. If the aforementioned atomic ratio of membranous conductivity is low at less than 0.55 and 0.90 is exceeded, a membranous etching property or resistance to moist heat will fall.

[0024] The above-mentioned amorphous oxide film which contains an indium element and a zinc element as a main cation element may contain only an indium element and a zinc element substantially as a cation element, and may contain one or more sorts of 3rd elements whose valences are more than trivalent [forward] as cation elements other than an indium element and a zinc element. As an example of said 3rd element, tin (Sn), aluminum (aluminum), antimony (Sn), a gallium (Ga), germanium (germanium), and titanium (Ti) are mentioned. As for the content of the 3rd element, it is desirable that it is the amount from which atomic ratio (all 3rd elements)/(the In+Zn+ all 3rd element) of the total amount becomes 0.2 or less. If the atomic ratio of the total amount of the 3rd element exceeds 0.2, membranous conductivity will tend to fall.

[0025] The amorphous transparence electric conduction film can be directly formed on the dampproof inorganic oxide film mentioned above by approaches, such as the ECR plasma (electronic SAIKU roton resonance plasma) sputtering method and the magnetron sputtering method. As for the substrate temperature at the time of membrane formation, at this time, it is desirable that the transparence thermosetting resin substrate mentioned above considers as the temperature which does not cause heat deformation substantially from the same reason as the case where the dampproof inorganic oxide film is formed. After forming the amorphous transparence electric conduction film on the dampproof inorganic oxide film, UV ozone exposure and ion irradiation may be performed if needed. By performing UV ozone exposure and ion irradiation, defecation of an amorphous transparence electric conduction film front face can be attained, without damaging a transparence thermosetting resin substrate.

[0026] The thickness of the transparent electrode which consists of the crystalline substance transparence electric conduction film or amorphous transparence electric conduction film mentioned above is suitably chosen according to the quality of the material so that desired conductivity, light transmission nature, etc. may be obtained. For example, the thickness of the transparent electrode which consists of a crystalline substance ITO is selectable suitably within the limits of 100-10000A in general. It is desirable to consider as 100-2000A especially from a viewpoint of raising light transmittance. Moreover, the thickness of the transparent electrode which consists of amorphous oxide film which contains an indium element and a zinc element as a main cation element is selectable suitably within the limits of 3-3000nm, when atomic ratio In/(In+Zn) of the indium in the amorphous oxide film concerned is 0.55-0.90. In this case, as for the thickness of the transparent electrode which consists of the amorphous oxide film concerned, it is desirable that it is 5-1000nm, and it is desirable that it is especially 10-800nm.

[0027] A transparent electrode can be obtained by using the mask which has opening of the predetermined configuration corresponding to the configuration of the transparent electrode made into the purpose, in case the crystalline substance transparence electric conduction film or amorphous transparence electric conduction film mentioned above is formed. Moreover, in obtaining the transparence electric-conduction film mentioned above by performing UV ozone exposure or ion irradiation after membrane formation, in case it forms the transparence electric-conduction film set as the object of UV ozone exposure or ion irradiation, the target transparent electrode can be obtained by using the mask which has opening of the predetermined configuration corresponding to the configuration of the transparent electrode made into the purpose, and performing UV ozone exposure or ion irradiation next.
[0028] Or once forming the film of a large area which consists of the crystalline substance transparence electric conduction film or amorphous transparence electric conduction film mentioned above, the target transparent electrode can be obtained also by carrying out patterning of this film to a request configuration by the photolithography method etc. furthermore, in obtaining the transparent electrode which consists of transparence electric conduction film mentioned above by performing UV ozone exposure or ion irradiation after membrane formation The film of a large area which consists of transparence electric conduction film set as the object of UV ozone exposure or ion irradiation is once formed. [whether after carrying out patterning of this film to a request configuration by the photolithography method etc., UV ozone exposure or ion irradiation is performed, and] Or after performing UV ozone exposure or ion irradiation on the film of said large area, the target transparent electrode can be obtained by carrying out patterning to a request configuration by the photolithography method etc.
[0029] In the organic EL device of this invention, the organic monolayer section or the organic multilayer section containing an organic luminescent material is formed on the transparent electrode mentioned above, and the counterelectrode is formed on this organic monolayer section or the organic multilayer section. The lamination itself that the organic monolayer section or the organic multilayer section is formed on the transparent electrode, and the counterelectrode is formed on this organic monolayer section or the organic multilayer section is the same as the conventional organic EL device which makes a transparence substrate side an optical drawing side.
[0030] That is, the lamination which applies a transparence substrate side to a counterelectrode (cathode) from the transparent electrode (anode plate) in the organic EL device of the type made into an optical drawing side is following (1). - (4) The lamination applied to a counterelectrode (cathode) from the transparent electrode (anode plate) in the organic EL device of this invention although it can divide roughly into lamination is following (1). - (4) It can be made either.
(1) A transparent electrode (anode plate) / luminous layer / counterelectrode (cathode)
(2) A transparent electrode (anode plate) / electron hole transportation layer / luminous layer / counterelectrode (cathode)
(3) A transparent electrode (anode plate) / luminous layer / electronic injection layer / counterelectrode (cathode)
(4) A transparent electrode (anode plate) / electron hole transportation layer / luminous layer / electronic injection layer / counterelectrode (cathode)
[0031] Here, although a luminous layer is usually formed of one sort or two or more sorts of organic luminescent material, it may be formed of the polymeric materials which distributed mixture with an organic luminescent material, an electron hole transportation ingredient, and/or an electron injection ingredient, the mixture concerned, or an organic luminescent material. Moreover, as the organic EL device concerned is covered on the periphery of the organic EL device of lamination mentioned above, the closure layer for preventing invasion of the moisture to an organic EL device or oxygen may be prepared.
[0032] Above (1) In the organic EL device of a type, a luminous layer is equivalent to "the organic monolayer section containing an organic luminescent material" as used in the field of this invention. Above (2) In the organic EL device of a type, an electron hole transportation layer and a luminous layer

are equivalent to the "organic [containing an organic luminescent material] multilayer section" as used in the field of this invention. Above (3) In the organic EL device of a type, a luminous layer and an electronic injection layer are equivalent to the "organic [containing an organic luminescent material] multilayer section" as used in the field of this invention. Above (4) In the organic EL device of a type, an electron hole transportation layer, a luminous layer, and an electronic injection layer are equivalent to the "organic [containing an organic luminescent material] multilayer section" as used in the field of this invention. As an ingredient of a luminous layer, an electron hole transportation layer, an electronic injection layer, and a counterelectrode (cathode), various ingredients can be used, respectively.

[0033] For example, as an organic compound usable as an ingredient (organic luminescent material) of a luminous layer, although there is especially no limitation, fluorescent brighteners, such as a benzothiazole system, a benzimidazole system, and a benzooxazole system, are used. As these examples, it is 2 and 5-screw (5, 7-G t-pentyl-2-benzoxazolyl). - 1, 3, 4-thiadiazole, A 4 and 4'-bis(5, 7-t-pentyl-2-benzoxazolyl) stilbene, 4 and 4' bis[-] [5 and 7-G (2-methyl-2-butyl)-2-benzoxazolyl] stilbene, 2, a 5-bis(5, 7-G t-pentyl-2-benzoxazolyl) thiophene, 2, a 5-bis[5-alpha and alpha-dimethylbenzyl-2-benzoxazolyl] thiophene, 2, 5-screw [5 and 7-G (2-methyl-2-butyl)-2-benzoxazolyl]-3, 4-diphenyl thiophene, 2, a 5-bis(5-methyl-2-benzoxazolyl) thiophene, A 4 and 4'-bis(2-benzoxazolyl) biphenyl, Benzooxazole systems, such as 5-methyl-2-[2-[4-(5-methyl-2-benzoxazolyl) phenyl] vinyl] benzooxazole and 2-[2-(4-chlorophenyl) vinyl] [1 and 2-naphth d] oxazole, 2 2' -(p-phenylenedivinylene)- Benzothiazole systems, such as screw benzothiazole, 2-[2-[4-(2-benzoimidazolyl) phenyl] vinyl] benzimidazole, 2-[2 - (4-carboxyphenyl vinyl] fluorescent brighteners, such as benzimidazole systems, such as benzimidazole, are mentioned.)

[0034] A metal chelation oxy-NOIDO compound is also used as an organic luminescent material. As the example For example, tris (eight quinolinol) aluminum, bis(eight quinolinol) magnesium, Bis([Benzof]-eight quinolinol) zinc, bis(2-methyl-8-quinolate) aluminum oxide, A tris (eight quinolinol) indium, tris (5-methyl-eight quinolinol) aluminum, An eight-quinolinol lithium, a tris (5-chloro-eight quinolinol) gallium, 8-hydroxyquinoline system metal complexes, dilithium EPINTORI dione, etc., such as bis(5-chloro-eight quinolinol) calcium and Pori [zinc (II)-bis(8-hydroxy-5-KINORI nonyl) methane], are mentioned.

[0035] A styryl benzenoid compound is also used as an organic luminescent material. As the example For example, 1, 4-bis(2-methyl styryl) benzene, 1, 4-bis(3-methyl styryl) benzene, 1, 4-bis(4-methyl styryl) benzene, JISUCHIRIRU benzene, 1, 4-bis(2-ethyl styryl) benzene, 1, 4-bis(3-ethyl styryl) benzene, 1, 4-bis(2-methyl styryl)-2-methylbenzene, 1, and 4-bis(2-methyl styryl)-2-ethylbenzene etc. is mentioned.

[0036] A JISUCHIRIRU pyrazine derivative is also used as an organic luminescent material. Moreover, as the example For example, 2, 5-bis(4-methyl styryl) pyrazine, 2, 5-bis(4-ethyl styryl) pyrazine, 2 and 5-bis[2-(1-naphthyl) vinyl] pyrazine, 2, 5-bis(4-methoxy styryl) pyrazine, 2, and 5-bis[2-(4-biphenyl) vinyl] pyrazine, 2, and 5-bis[2-(1-pyrenyl) vinyl] pyrazine etc. is mentioned.

[0037] As other organic luminescent material, for example, a specific polyphenyl system compound, 12-phtalo peri non, 1, 4-diphenyl-1,3-butadiene, 1, 1, 4, and 4-tetra-phenyl-1,3-butadiene, the North America Free Trade Agreement RUIMIDO derivative, A perylene derivative, an OKISA diazole derivative, an aldazine derivative, a PIRAJIRIN derivative, A cyclopentadiene derivative, a pyrrolo pyrrole derivative, a styryl amine derivative, Coumarin system compound and 1, 4-phenylene dimethylidyne, 4, and 4'-phenylene dimethylidyne, 2, 5-xylylene dimethylidyne, 2,6-naphthylene group dimethylidyne, 1, 4-biphenylene dimethylidyne, 1, 4-p-tele phenylene dimethylidyne, A 9, 10-anthracene diyl dimethylidyne, 4, and 4'-(2 and 2-G t-buthylphenyl vinyl) biphenyl, Aromatic series dimethylidyne system compounds, such as a 4 and 4'-(2 and 2-diphenyl vinyl) biphenyl, and these derivatives, other specific high molecular compounds, etc. can be mentioned.

[0038] as the approach of forming a luminous layer using the above-mentioned organic luminescent material -- vacuum deposition, a spin coat method, the cast method, and LB -- well-known approaches, such as law, are applicable. As for especially a luminous layer, it is desirable that it is the molecule deposition film. the thing of the thin film which deposition was carried out to the molecule deposition

film from the ingredient compound of a gaseous-phase condition here, and was formed, and the film solidified and formed from the ingredient compound of a solution condition or a liquid phase condition -- it is -- usually -- this molecule deposition film -- LB -- with the thin film (molecule built up film) formed of law, it is classifiable with the difference of condensation structure and higher order structure, and the functional difference resulting from it. Moreover, after melting a binder and organic luminescent material, such as resin, to a solvent and considering as a solution, a luminous layer can be formed also by thin-film-izing this with a spin coat method etc. Thus, although there is especially no limit about the thickness of the luminous layer formed and it can choose suitably according to a situation, the range of 5nm - 5 micrometers is usually desirable.

[0039] The luminous layer in an organic EL device offers the place of the recombination of the transportation function and the electron to which the charge (an electron and electron hole) which can pour in an electron hole from a transparent electrode (anode plate) or an electron hole transportation layer at the time of electric-field impression, and can pour an electron into it from a counterelectrode (cathode) or an electronic injection layer, and which it impregnation-functioned and was poured in is moved by the force of electric field, and an electron hole, and has the luminescence function tie this to luminescence etc. In addition, an electron hole is poured in, easy and an electron are poured in and a difference may be between easy. Moreover, although size may be in the transportation function in which it is expressed with the mobility of an electron hole and an electron, it is desirable to move either at least.

[0040] As an ingredient of the electron hole transportation layer prepared if needed between a transparent electrode (anode plate) and a luminous layer, it can be used out of what is commonly used as a hole-injection ingredient of photoconductive material conventionally, or the well-known thing currently used for the electron hole transportation layer of an organic EL device, being able to choose the thing of arbitration. The ingredient of an electron hole transportation layer may have impregnation of an electron hole, or electronic obstruction nature, and may be any of the organic substance or an inorganic substance.

[0041] as an example -- for example, an imidazole derivative, the poly aryl alkane derivative, a pyrazoline derivative and a pyrazolone derivative, a phenylenediamine derivative, an arylamine derivative, an amino permutation chalcone derivative, an oxazole derivative, a styryl anthracene derivative, and full -- me -- non, specific conductive polymer oligomer, such as a derivative, a hydrazone derivative, a stilbene derivative, a silazane derivative, a polysilane system, an aniline system copolymer, and thiophene oligomer, etc. can be raised.

[0042] Although the above-mentioned thing can be used as an ingredient of an electron hole transportation layer, it is desirable to use a porphyrin compound, an aromatic series tertiary-amine compound or a styryl amine compound, especially an aromatic series tertiary-amine compound.

[0043] As an example of the above-mentioned porphyrin compound, porphyrin, 1, 10 and 15, 20-tetrapod phenyl-21H, and 23H-porphin copper (II), 1, 10, 15, 20-tetrapod phenyl-21H, and 23H-porphin zinc (II), 5, 10, 15, 20-tetrakis (pentafluorophenyl)-21H, and 23H-porphin, Silicon phthalocyanine oxide, aluminum phthalocyanine chloride, A phthalocyanine (non-metal), a dilithium phthalocyanine, a copper tetramethyl phthalocyanine, A copper phthalocyanine, a chromium phthalocyanine, a zinc phthalocyanine, a lead phthalocyanine, titanium phthalocyanine oxide, a magnesium phthalocyanine, a copper octamethyl phthalocyanine, etc. can be mentioned.

[0044] moreover, as an example of representation of said aromatic series tertiary-amine compound and a styryl amine compound N, N, N', and N' -- the - tetra-phenyl -4 and 4' - diamino phenyl -- N, N'-diphenyl-N, N'-screw-(3-methylphenyl)-(1 and 1'-biphenyl)-4, 4'-diamine, A 2 and 2-bis(4-G p-tolylamino phenyl) propane, 1, and 1-bis(4-G p-tolylamino phenyl) cyclohexane, N, N, N', and N' -- the - tetra--p-tolyl -4 and 4' - diamino biphenyl -- 1 and 1-bis(4-G p-tolylamino phenyl)-4-phenylcyclohexane, A bis(4-dimethylamino-2-methylphenyl) phenylmethane, A bis(4-G p-tolylamino phenyl) phenylmethane, N, N'-diphenyl-N, N'-JI (4-methoxypheny) -4, a 4'-diamino biphenyl, N, N, N', and N' -- the - tetra-phenyl -4 and 4' - diamino diphenyl ether -- 4 and 4'-bis(diphenylamino) KUODORI phenyl, N and N, N-Tori (p-tolyl) amine, 4-(G p-tolylamino)-4'-[4 (G p-tolylamino) Styryl] stilbene, 4-N

and N-diphenylamino-(2-diphenyl vinyl) benzene, 3-methoxy-4'-N, and N-diphenylamino still benzene, N-phenyl carbazole, etc. are mentioned. Moreover, the above-mentioned aromatic series dimethylidyne system compound shown as an organic luminescent material can also be used as an ingredient of an electron hole transportation layer.

[0045] the compound which mentioned the electron hole transportation layer above -- for example, a vacuum deposition method, a spin coat method, the cast method, and LB -- it can form by thin-film-izing by well-known approaches, such as law. Although especially the thickness as an electron hole transportation layer is not limited, it is usually 5nm - 5 micrometers. This electron hole transportation layer may be 1 layer structure which consists of one sort of the ingredient mentioned above, or two sorts or more, and may be double layer structure which consists of two or more layers of the same presentation or a different-species presentation.

[0046] As the ingredient, the thing of arbitration can be chosen and used for the electronic injection layer formed if needed between a luminous layer and a counterelectrode (cathode) out of a conventionally well-known compound that what is necessary is just to have the function to transmit the electron poured in from the counterelectrode (cathode) to a luminous layer.

[0047] as an example -- a triazole derivative, an OKISA diazole derivative, and nitration full -- me -- non, heterocycle tetracarboxylic acid anhydrides, such as a derivative, an anthra quinodimethan derivative, a diphenyl quinone derivative, a thiopyran dioxide derivative, and naphthalene perylene, a carbodiimide, a deflection ORENIRIDEN methane derivative, an anthra quinodimethan derivative and an anthrone derivative, an OKISA diazole derivative, other specific electron transport nature compounds, etc. can be mentioned.

[0048] Moreover, the metal complex of an eight-quinolinol derivative, tris (eight quinolinol) aluminum, tris (5, 7-dichloro-eight quinolinol) aluminum, tris (5, 7-dibromo-eight quinolinol) aluminum, tris (2-methyl-eight quinolinol) aluminum, etc. the metal complex that the central metal of these metal complexes placed and replaced with In, Mg, Cu, calcium, Sn, or Pb, etc. can specifically be used as an ingredient of an electronic injection layer. In addition, that by which a metal free-lancer, metal phthalocyanines, or those ends are permuted by the alkyl group, the sulfone radical, etc. is also desirable. Moreover, the JISUCHIRIRU pyrazine derivative illustrated as an ingredient of a luminous layer can also be used as an ingredient of an electronic injection layer.

[0049] the compound which mentioned the electronic injection layer above -- for example, a vacuum deposition method, a spin coat method, the cast method, and LB -- it can form by thin-film-izing by well-known approaches, such as law. Although there is especially no limit in the thickness of an electronic injection layer, it is usually 5nm - 5 micrometers. This electronic injection layer may be 1 layer structure which consists of one sort of the ingredient mentioned above, or two sorts or more, and may be double layer structure which consists of two or more layers of the same presentation or a different-species presentation.

[0050] In addition, as an ingredient of an electron hole transportation layer, they are p mold-Si and p mold. - Inorganic compounds, such as SiC, can also be used and they are n mold-Si and n mold also as an ingredient of an electronic injection layer. - Inorganic compounds, such as SiC, can also be used. As an example of the inorganic material for electron hole transportation layers, and the inorganic material for electronic injection layers, the inorganic semi-conductor currently indicated by the international public presentation official report WO 90-05998 can be mentioned.

[0051] And as an ingredient of a counterelectrode (cathode), the small (for example, 4eV or less) metal of a work function, an alloy, electrical conductivity compounds, or such mixture are used preferably. As an example, rare earth metals, such as the alloy of a sodium and sodium-potassium alloy, magnesium, a lithium, magnesium, and silver or a mixed metal, magnesium-copper mixture, aluminum, aluminum/aluminum 2O3, an indium, and an ytterbium, etc. are mentioned.

[0052] Although a counterelectrode can form the ingredient mentioned above by thin-film-izing by approaches, such as a vacuum deposition method and the sputtering method, forming with a vacuum deposition method especially is desirable. Although the counterelectrode does not need to have substantially the light transmission nature to EL light from a luminous layer and the thickness is based

also on the ingredient of a counterelectrode, it is usually selectable suitably within the limits of 10nm - 1 micrometer. Below hundreds of ohms / ** of the sheet resistance of a counterelectrode are desirable. In addition, in case the ingredient of a counterelectrode is chosen, the magnitude of the work function made into criteria is not limited to 4eV.

[0053] In the organic EL device of this invention, the organic monolayer section (layer which consists only of a luminous layer) or the organic multilayer section (layer which has one side that there are few the electron hole transportation layers and electronic injection layers other than a luminous layer) containing an organic luminescent material mentioned above on the transparent electrode mentioned above is formed, and the counterelectrode mentioned above on this organic monolayer section or the organic multilayer section is prepared. The organic EL device concerned may have the closure layer for preventing invasion of the moisture to a component, or oxygen like the conventional organic EL device.

[0054] The copolymer which is made to carry out copolymerization of the monomer mixture containing tetrafluoroethylene and at least one sort of comonomers as an example of the ingredient of a closure layer, and is obtained, The fluorine-containing copolymer which has cyclic structure in a copolymerization principal chain, polyethylene, polypropylene, Polymethylmethacrylate, polyimide, polyurea, polytetrafluoroethylene, Polychlorotrifluoroethylene resin, poly dichlorodifluoroethene, The copolymer of chlorotrifluoroethylene and dichlorodifluoroethene, The absorptivity matter of 1% or more of water absorption, and the dampproof matter of 0.1% or less of water absorption, Metals, such as In, Sn, Pb, Au, Cu, Ag, aluminum, Ti, and nickel, MgO, SiO, SiO2, aluminum 2O3, GeO, NiO, CaO, BaO and Fe 2O3, Y2 O3, the metallic oxide of TiO2 grade, MgF2, LiF, AlF3, and CaF2 etc. -- the thing which made liquefied fluorination carbon and the liquefied fluorination carbon concerned, such as a metal fluoride, a perfluoro alkane, a perfluoro amine, and a perfluoro polyether, distribute the adsorbent which adsorbs moisture and oxygen is mentioned.

[0055] if in charge of formation of a closure layer -- a vacuum deposition method, a spin coat method, the sputtering method, the cast method, and MBE (molecular beam epitaxy) -- law, the ionized cluster beam method, the ion plating method, a plasma polymerization method (the high-frequency excitation ion plating method), a reactive-sputtering method, a plasma-CVD method, a laser CVD method, a heat CVD method, a gas source CVD method, etc. are applicable suitably. In using for liquefied fluorination carbon or the liquefied fluorination carbon concerned what distributed the adsorbent which adsorbs moisture and oxygen as an ingredient of a closure layer The organic EL device currently formed on the substrate (there may already be another closure layer.) Outside in collaboration with the aforementioned substrate, an organic EL device is formed for wrap housing material, forming an opening between the organic EL devices concerned. It is desirable to form a closure layer in the space formed of the aforementioned substrate and the aforementioned housing material by filling up aforementioned liquefied fluorination carbon and the aforementioned liquefied fluorination carbon concerned with what distributed the adsorbent which adsorbs moisture and oxygen. What consists of the small glass or the small polymer (for example, 3 fluoride-salt-ized ethylene) of water absorption as the aforementioned housing material is used suitably. The particle which may prepare only the housing material concerned, without preparing the closure layer mentioned above in using housing material, and prepares the layer of the adsorption material which adsorbs oxygen and water in the space formed by the housing material concerned and the aforementioned substrate after preparing housing material, or consists of the adsorption material concerned may be distributed.

[0056] In spite of using the resin substrate for the organic EL device of this invention explained above as a transparence substrate, it is an organic EL device which there is no brightness nonuniformity and can obtain what has high luminescence stability. There is no brightness nonuniformity and the reason which can obtain what has high luminescence stability is guessed as follows.

[0057] That is, in the organic EL device of this invention, since the transparence thermosetting resin substrate which has a flat side is used as a transparence resin substrate, a transparent electrode with surface surface smoothness higher than the transparent electrode formed on the thermoplastics substrate is obtained by forming the dampproof inorganic oxide film as mentioned above on said flat side of this transparence thermosetting resin substrate, and forming a transparent electrode as mentioned above on

this dampproof inorganic oxide film. And in the organic EL device obtained by carrying out the laminating of the organic monolayer section or the organic multilayer section, and the counterelectrode (cathode) one by one by the approach mentioned above on the transparent electrode concerned, it is expected that the gap between a transparent electrode and a counterelectrode is comparatively uniform, and the electrical potential difference built between a transparent electrode and a counterelectrode is also again comparatively uniform. If the electrical potential difference built between a transparent electrode and a counterelectrode is comparatively uniform, it will be hard to happen that the high voltage arises locally between a transparent electrode and a counterelectrode, there will be no brightness nonuniformity as the result, and an organic EL device with high luminescence stability will be obtained. Therefore, by manufacturing an organic EL device, as it mentioned above using the transparence thermosetting resin substrate which has the flat side mentioned above as a transparence resin substrate, there is no brightness nonuniformity and it becomes possible to obtain an organic EL device with high luminescence stability.

[0058] In addition, there is no field with a diameter of 50 micrometers or more non-emitted light with there "there being no brightness nonuniformity" as used in the field of [nothing] this invention, it means that there is no difference in brightness and a color by the location within a luminescence side, and after making the light switch on continuously from initial lighting (except for aging) for 50 hours with "luminescence stability being high" as used in the field of this invention, it means that there is "no brightness nonuniformity" as used in the field of this invention. The existence and an area size non-emitted light of the field non-emitted light are a component 100 cd/m2 Light is made to emit by brightness, and it can judge or measure by observing the luminescence side at this time using a luminance meter. Moreover, the existence of the difference between the brightness by the location within a luminescence side and a color can be judged or measured similarly.

[0059]

[Example] Hereafter, the example of this invention is explained.

As an example 1(1) transparence thermosetting resin substrate transparence resin substrate, the acrylic transparence thermosetting tree substrate (93% of total light transmission) with a magnitude of 30x25x1mm was prepared. This acrylic transparence thermosetting resin substrate is cut down from the KURERAKKUSU precision plate flat S type (trade name) by the Japanese east resin industrial company, and the precision plate concerned is fabricated to a precision by the casting polymerization method. Moreover, they were 15 pieces as a result of the gestalt observation when the mean square value of the surface roughness of the flat side concerned which both sides of this acrylic transparence thermosetting resin substrate consisted of a "flat side" as used in the field of this invention, and was searched for using the Sloane (Sloan) sensing-pin type surface roughness meter (trade name: DEKTAK3030) exists in the field of 500 - micrometer angle on 100A and the flat side concerned accord [the number of the projections of 600A or more] to an atomic force microscope.

[0060] (2) The dampproof inorganic oxide film of 600A of thickness which consists of a silicon oxide (SiOx) was formed by the reactive sputtering method for having used Si for one side of the acrylic transparence thermosetting resin substrate of the formation above (1) of the dampproof inorganic oxide film as a sputtering target. Reactive sputtering at this time equips a sputtering system with an acrylic transparence thermosetting resin substrate, and decompresses the inside of a vacuum tub to 1x10 - 3 or less Pa. Ar gas (99.99% of purity), and O2 After introducing mixed gas (Ar:O 2 = 1000:2.8 (volume ratio)) with gas (99.99% of purity) in a vacuum tub until vaccum pressure was set to 1.0x10 to 1 Pa, it carried out on conditions with a target applied-voltage 400V and a substrate temperature of 80 degrees C.

[0061] (3) By the DC magnetron sputtering method using the sintered compact which consists of mixture (atomic ratio In/(In+Zn) =0.80 of In) of indium oxide and a zinc oxide as a formation sputtering target of a transparent electrode, the amorphous oxide film of 250nm of thickness which contains an indium element and a zinc element as a main cation element was formed on the dampproof inorganic oxide film formed above (2). DC magnetron sputtering at this time Equip DC magnetron sputtering system with the above-mentioned acrylic transparence thermosetting resin substrate which formed the

dampproof inorganic oxide film above (2), and the inside of a vacuum tub is decompressed to 1x10 - 3 or less Pa. Ar gas (99.99% of purity), and O2 After introducing mixed gas (Ar:O 2 = 1000:2.8 (volume ratio)) with gas (99.99% of purity) in a vacuum tub until vaccum pressure was set to 1.0x10 to 1 Pa, it carried out on conditions with a target applied-voltage 420V and a substrate temperature of 60 degrees C.

[0062] When asked for atomic ratio In/(In+Zn) of In in the obtained amorphous oxide film by ICP analysis (inductively coupled plasma-atomic emisson spectroscopy; SPS-1500VR [model / use] by the SEIKO electronic industry company), it was the 0.80 [same] as a sputtering target. Moreover, it was checked by X diffraction measurement (Rigaku Rota FREX RU-200B [model / use]) that the oxide film concerned is amorphous oxide film.

[0063] Subsequently, the above-mentioned acrylic transparence thermosetting resin substrate which even the amorphous oxide film formed It sprays and dries, after cleaning ultrasonically, using isopropyl alcohol as a penetrant remover. With UV ozone irradiation equipment (SAKOMU international lab 300 [UV-]) using the dominant wavelength of 2537A, and the 1849A light source, then, a substrate temperature room temperature, O2 UV ozone exposure was performed on the above-mentioned amorphous oxide film on the conditions for the amount part [for /] and processing-time 10 minutes of gas installation of 10l. The front face of the amorphous oxide film was defecated by this, and the target transparent electrode was obtained.

[0064] (4) Fix to the substrate holder of commercial vacuum evaporationo equipment (product made from Japanese Vacuum technology) the acrylic transparence thermosetting resin substrate which even the transparent electrode formed by the formation above (3) of an organic EL device. They are N, N'-diphenyl-N, N'-screw-(3-methylphenyl)-[1 and 1'-biphenyl]-4, and 4'-diamine (it is written as "TPD" below.) to the resistance heating boat made from molybdenum. It is tris (eight quinolinol) aluminum (it is written as "Alq3" below.) to the resistance heating boat made from molybdenum which puts in 200mg and is different. 200mg was put in and the vacuum tub was decompressed up to 1x10 to 4 Pa.

[0065] Then, said boat containing TPD was heated even at 215-220 degrees C, TPD was vapor-deposited on the above-mentioned transparent electrode with the evaporation rate of 1-3A/second, and the electron hole transportation layer of 600A of thickness was formed. The substrate temperature at this time was a room temperature. without it takes this out from a vacuum tub -- an electron hole transportation layer top -- Alq3 from -- the luminous layer of 600A of becoming thickness was formed. The vacuum evaporationo conditions at this time were made into the boat temperature of 230 degrees C, the evaporation rate of 0.1-0.2A/second, and the substrate temperature room temperature. This was taken out from the vacuum tub, the mask made from stainless steel was installed on the above-mentioned luminous layer, and it fixed to the substrate electrode holder again.

[0066] Next, magnesium ribbon 1g was put into the resistance heating boat made from molybdenum, and the different basket made from a tungsten was equipped with silver wire 500mg. Then, magnesium was made to vapor-deposit with the evaporation rate of 14A/second from another boat made from molybdenum with a resistance heating method at the same time it made silver vapor-deposit with the evaporation rate of 1A/second, after decompressing a vacuum tub up to 2x10 to 4 Pa. The counterelectrode of 1500A of thickness which consists of a mixed metal of magnesium and silver was formed on the luminous layer by this, and the target organic EL device was obtained. the electron hole transportation layer which consists of TPD in this organic EL device, and Alq3 from -- the organic multilayer section is formed of the becoming luminous layer.

[0067] (5) Make into an anode plate the transparent electrode of the organic EL device obtained by the evaluation above (4), use a counterelectrode as cathode, and the brightness of a component is 100 cd/m2. Direct-current electric field were impressed to the organic EL device concerned in atmospheric air so that it might become, and the conversion efficiency eta at this time was searched for by the degree type.

[Equation 1]

$\eta = 100\pi / (JV \times 10)$

η：変換効率（lm／W）
π：円周率
J：電流密度（mA／cm^2）
V：電圧（V）

[0068] Moreover, the luminescence side at this time was observed using the luminance meter (CS-100 by Minolta Camera Co., Ltd.), and the existence of the difference between the brightness by the location within the homogeneity of luminescence, i.e., the existence of the field non-emitted light, and a luminescence side and a color was evaluated. Furthermore, 100 cd/m2 The homogeneity of luminescence after carrying out a continuation drive by brightness for 50 hours was evaluated. These results are shown in Table 1.
[0069] The acrylic transparence thermosetting resin substrate used in the example 2 example 1, and the same quality, After forming the dampproof inorganic oxide film in one side of an acrylic isomorphism-like transparence thermosetting resin substrate like an example 1 (2), By the ECR plasma sputtering method using the sintered compact which consists of a multiple oxide (atomic ratio In/Sn=9/1 of ITO:In and Sn) of indium oxide and tin oxide as a sputtering target The transparent electrode which consists of crystalline substance ITO film of 120nm of thickness was formed on the dampproof inorganic oxide film.
[0070] Sputtering at this time equips a sputtering system with the acrylic transparence thermosetting resin substrate after forming the dampproof inorganic oxide film, and decompresses the inside of a vacuum tub to 1x10 - 3 or less Pa. Ar gas (99.99% of purity), and O2 After introducing mixed gas (Ar:O 2 = 1000:2.8 (volume ratio)) with gas (99.99% of purity) in a vacuum tub until vaccum pressure was set to 2.0x10 to 1 Pa, it carried out on conditions with a target applied-voltage 420V and a substrate temperature of 80 degrees C.
[0071] When asked for the grain size of the crystalline substance ITO film formed as mentioned above using the electric microscope, it was 200-500A. Moreover, each grain (microcrystal grain) was presenting the globular form or the spheroid form. Then, the electron hole transportation layer, the luminous layer, and the counterelectrode were formed like the example 1 (4) on the transparent electrode which consists of the above-mentioned crystalline substance ITO film, and the target organic EL device was obtained.
[0072] About this organic EL device, the same item as the item measured thru/or evaluated was measured thru/or evaluated by the example 1 (5) like the example 1 (5). These results are shown in Table 1.
[0073] The substrate (this substrate is hereafter called "PET substrate".) with a magnitude of 30x25x1mm which consists of a PET (polyethylene terephthalate) which is one of the thermoplastics as an example of comparison 1 transparence resin substrate was used. It was 410A when the mean square value of surface roughness was calculated like the example 1 (1) about this PET substrate. Moreover, they were 110 pieces when [which exists in the field of 500 micrometer angle on the PET substrate concerned] asked for the number of the projections of 600A or more like the example 1 (1). Therefore, this PET substrate does not have the "flat side" as used in the field of this invention. The transparent electrode which becomes one side of the above-mentioned PET substrate from the dampproof inorganic oxide film and the crystalline substance ITO film like an example 2 was formed, and the organic EL device was obtained. About this organic EL device, the same item as the item measured thru/or evaluated was measured thru/or evaluated by the example 1 (5) like the example 1 (5). These results are shown in Table 1.
[0074]
[Table 1]

表 1

	透明樹脂基板		透明電極の性状	有機EL素子*2		
	表面粗さの二乗平均値（オングストローム）	突起の数*1（個）		変換効率η（lm/W）	初期の発光均一性	連続駆動後の発光均一性*3
実施例1	100	15	非晶質	2.0	○	○
実施例2	110	14	グレインサイズ200～500オングストロームの結晶質	1.9	○	○
比較例1	410	110	グレインサイズ400～1000オングストロームの結晶質	1.8	△	×

＊1：平坦面上における500μm角の領域内に存在する600オングストローム以上の突起の数を示す。
＊2：○…直径50μm以上の無発光領域がなく、発光面内の位置によって輝度および色に違いがない。
△…直径50μm以上の無発光領域または発光面内の位置によっての輝度もしくは色に違いがあり、その割合が10％未満である。
×…無発光領域が10％以上ある。
＊3：50時間連続駆動後の発光均一性を示す。

[0075] Each organic EL device obtained in the example 1 and the example 2 excels the organic EL device with which conversion efficiency eta was acquired in the example 1 of a comparison rather than the organic EL device obtained in the example 1 of a comparison in high early luminescence homogeneity and all of luminescence homogeneity after a 50-hour continuation drive so that clearly from Table 1. In the organic EL device of the example 1 of a comparison, the field non-emitted light was already seen in the early phase, and, of course, the field non-emitted light was not accepted after the 50-hour continuation drive in the early phase with each organic EL device of an example 1 and an example 2 especially about luminescence homogeneity to the rate having increased to 50% or more after the 50-hour continuation drive. Moreover, of course in each organic EL device of an example 1 and an example 2, the difference between the brightness by the location within a luminescence side and a color was not accepted in after a 50-hour continuation drive in the early phase. Thus, each organic EL device of an example 1 and an example 2 does not have brightness nonuniformity, and its luminescence stability is high.

[0076]

[Effect of the Invention] As explained above, it is the component which there is no brightness nonuniformity and can obtain what has high luminescence stability in spite of using the transparence resin substrate for the organic EL device of this invention as a transparence substrate. Therefore, according to this invention, it is more nearly lightweight than the organic EL device using the glass substrate as a transparence substrate, and excels in shock resistance, and there is no brightness nonuniformity, and it becomes possible to offer an organic EL device with high luminescence stability.

[Translation done.]